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SEWAGE STABILIZATION POND DESIGN FACTORS

Public Health Service
Cincinnati, Ohio

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1. General. A sewage stabilization pond is a structure specifically designed to treat liquid organic wastes by biological, chemical, and physical processes commonly referred to as natural self-purification. It is normally a relatively shallow, diked structure and may receive either raw or pre-treated sewage. Throughout the Missouri River Basin, most of the ponds are operated on raw sewage, while throughout the Southwestern States, by far the large majority receive either primary or secondary effluents. The following statements, based upon Public Health Service field studies of selected stabilization ponds, may serve as guide lines for engineers responsible for the design of such facilities.

2. Location. The same general considerations should be applied to site selection for stabilization ponds as for conventional type treatment plants.

2.1. Where ice coverage occurs, the resulting anaerobic conditions create some odor potential during the transition period from ice cover to open water, and reasonable isolation is desirable. In such areas, ponds should be located approximately 1/4 mile from habitation. It may be possible to reduce this distance where aerobic conditions can be maintained throughout the year.

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2.2. If practicable, ponds should be located so that local prevailing winds will be in the direction of non-inhabited areas.

2.3. Preference should be given to sites which will permit an unobstructed wind sweep across the pond. This is believed to be more important in connection with raw sewage ponds than with those receiving settled sewage.

2.4. All surface drainage from adjacent areas should be excluded.

2.5. Proximity of ponds to water supplies and ground water aquifers should be critically evaluated in accordance with sound sanitary practices.

3. Area - Loading. Loadings ranging from 20 to greater than 50 lbs. of 5-day BOD per acre of surface area per day, have been successfully treated in stabilization ponds. The lower figure is common in the Northern Plains States where heavy ice coverage is common. Higher loadings are standard practice in the Southwestern States.

4. Shape. The shape of ponds should be uniform and essentially square or rectangular, with no coves, peninsulas, or islands where floating material may accumulate.

5. Depth. It should be possible to vary the operating depth from 2 to 5 feet.

5.1. A minimum of $2\frac{1}{2}$ to 3 ft. has been found desirable to keep down the growth of rooted aquatic plants which encourage mosquito propagation.

5.2. Where appreciable ice coverage is anticipated, winter operation should allow for a liquid depth of 2 ft. beneath the ice.

5.3. A depth of 3 to 5 ft. may be beneficial in maintaining lower pond temperatures during summer operation. Excessively high temperatures , which may otherwise occur in some regions would not be conducive to optimum algal growth.

6. Inlets.

6.1. Center or near center inlets are suggested, especially for raw sewage. Such an arrangement will favor the maximum effects of wind induced currents to disperse the settleable sewage solids throughout the pond.

6.2. Effluents from primary stabilization ponds may be discharged at the shoreline of subsequent ponds.

6.3. The inlet line may be placed on the bottom, or supported on posts above the bottom either above or beneath the liquid surface. Horizontal discharges onto a concrete apron to prevent bottom scouring have proved satisfactory.

7. Outlets.

7.1. The outlet structure should provide for surface or subsurface withdrawals and for varying the pond operating levels.

7.2. In cold climates, the structure must be so constructed that ice formation will neither stop the overflow nor damage the structure.

7.3. The outlet structure should be located at a point most distant from the inlet, although no evidence of short circuiting or dead areas has been observed at ponds having center inlet and peripheral outlet. Wind induced currents have a far greater effect on the flow pattern within the pond than does the shape and relative location of inlet and outlet structures.

7.4. Facilities should be provided to drain the pond.

8. Dikes.

8.1. Attention should be given to soil characteristics used in the dikes and to proper soil compaction during construction.

8.2. Top widths should be adequate to permit access of maintenance vehicles. Eight feet has been found to be sufficient.

8.3. Inside slopes ranging from 3 to 4 horizontal to 1 vertical, are suggested for small ponds with flatter slopes being desirable on ponds of large surface area to minimize erosion from wave action.

8.4. Freeboard above the maximum water line should approximate 3 ft. for ponds having surface areas greater than one acre.

8.5. Dikes should be seeded above the water line with a native, short stemmed, shallow rooted grass.

9. Pond Bottom. The pond bottom should be essentially level and free of vegetation when placed in operation.

10. Miscellaneous.

10.1. The pond areas should be completely surrounded with stock-tight fences.

10.2. Appropriate signs should be provided to designate the nature of the facility.

10.3. Single cell vs. multiple cell ponds. In raw sewage ponds operating in series, the settleable sewage solids are practically all deposited in the first cell. Consequently, the loading on this primary cell should be governed by the same criteria relating to a single pond system. (See #3)

10.4. Appropriate consideration must be given to water loss by evaporation or seepage to insure that a minimum liquid level is maintained.

10.5. The owner of the pond should be impressed with the necessity of providing adequate maintenance. Protection against erosion, vegetation growths favoring insect propagation, and control of burrowing animals are some of the more common problems requiring attention.